

TYPHOON ZELDA (31W)

I. HIGHLIGHTS

Typhoon Zelda was the last tropical cyclone of the year, and may have set a record by being the fifth midget of the year to occur in the western North Pacific. Intensification during the early stages of its development proved difficult to handle because of its very small size. The operations of the missile test range located at Kwajalein and nearby islands and atolls were seriously affected.

II. TRACK AND INTENSITY

Westerly winds along the equator associated with the onset phase of the El Niño phenomenon helped to generate a weak cyclonic circulation near the international date line in late November. At 250600Z, persistent convection near the weak circulation center that was to become Zelda led to its inclusion on the Significant Tropical Weather Advisory. Strong vertical wind shear initially hampered intensification, but improved upper-level outflow at 262100Z indicated the disturbance had good potential for development, prompting a Tropical Cyclone Formation Alert. At 271800Z, the first warning was issued. Over the next 36 hours, Tropical Depression 31W moved west-northwestward and rapidly intensified to minimal typhoon intensity as it moved through the Marshall Islands. Kwajalein (WMO 91366) reported winds gusting to 71 kt (37 m/sec) as the eye of the midget passed 25 nm (45 km) south of the atoll at 290300Z. Zelda was upgraded to a typhoon at 291200Z based on reports from the Automatic Meteorological Observing Station (AMOS) at Ujae (WMO 91365) which measured sustained surface winds of 65 kt (33 m/sec) (Figure 3-31-1). Zelda continued to track west-northwestward, reaching a peak intensity of 80 kt (41 m/sec) at 301200Z approximately 160 nm (295 km) west of Enewetak. Shortly thereafter, a deep trough induced by Super Typhoon Yuri (30W), which

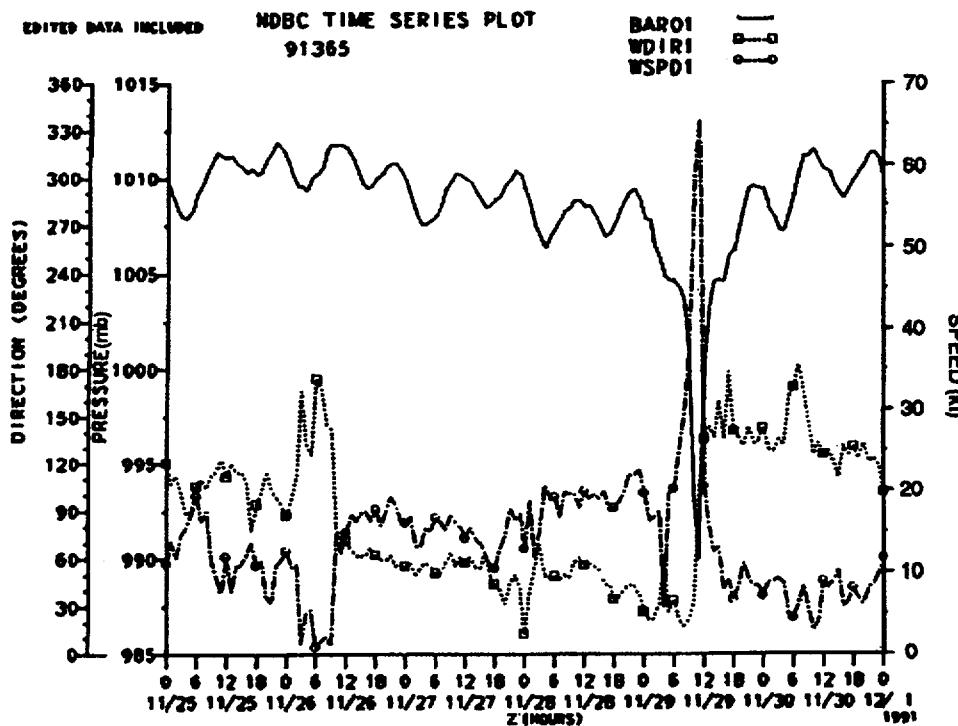


Figure 3-31-1 Time series of wind and pressure observations taken by the Automated Meteorological Observing Station (AMOS) on Ujae Atoll from 250000Z to 302300Z November. Maximum surface winds recorded at 291200Z were 65 kt (33 m/sec), and the minimum pressure dropped to 989 mb (Data courtesy of the National Data Buoy Center).

was about 1000 nm (1850 km) to the northwest, weakened the subtropical ridge, and Zelda turned northward near 157°E (Figure 3-31-2). After recurving, it trailed along a frontal boundary generated by the extratropical remnants of Yuri. As Zelda raced eastward, upper-level winds increased and its central convection sheared away. The remaining low-level circulation detached from the frontal cloud line and drifted slowly north-northwestward. The final warning on Zelda and the final warning of 1991 was issued on 4 December at 1800Z.

III. FORECAST PERFORMANCE

JTWC's experience with Typhoon Zelda emphasized the difficulties associated with performing infrared satellite analyses of midlevel tropical cyclones. It underscored the need to use visual and infrared image pairs when available. Due to its small size and seemingly poorly organized outflow pattern, Zelda did not have an impressive infrared satellite signature. Based on a Dvorak intensity estimate of 25 kt (13 m/sec) at 282330Z, the 290000Z warning indicated Zelda was still a tropical depression. But, when radar and synoptic reports from Kwajalein indicated otherwise, the warning was amended to upgrade Zelda to tropical storm intensity. In post-analysis, it is estimated that Zelda actually became a tropical storm at 280000Z, 24 hours earlier and was approaching severe tropical storm intensity as it passed Kwajalein's missile test range, which was caught unprepared by the stronger than forecast winds. Later, Zelda's sharp recurvature track was not anticipated by the JTWC (Figure 3-31-3), and average track forecast errors at 72 hours after 290000Z were 500 nm (925 km).

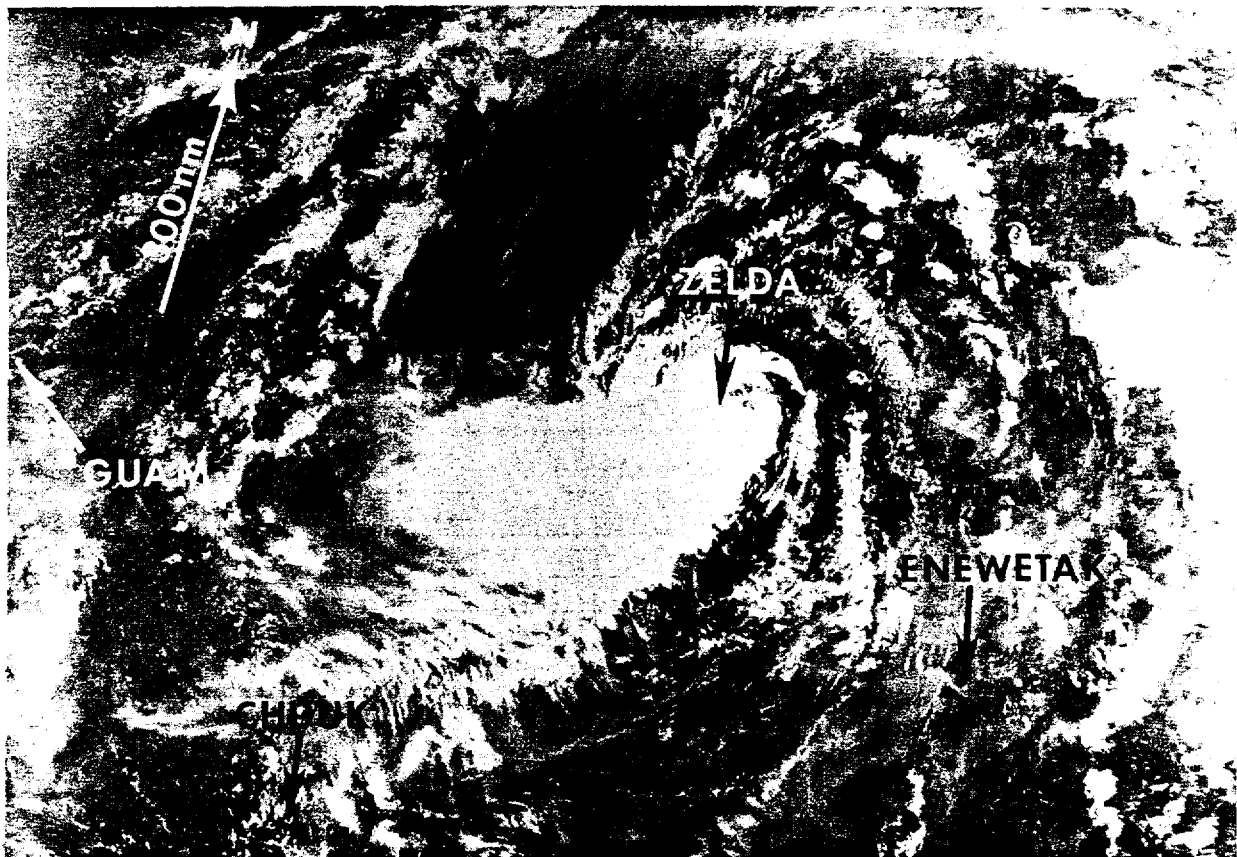


Figure 3-31-2. Typhoon Zelda near its point of recurvature (010903Z December NOAA infrared imagery).

IV. IMPACT

As the Mariana Islands were recovering from giant-sized Super Typhoon Yuri (30W), it was tiny Zelda that left more people homeless and injured. An estimated 5,000 people lost their plywood and sheet-iron-roofed homes on Ebeye atoll, and 27 people were injured. On 9 December, President Bush signed a major disaster declaration, making Ebeye Island and the atolls of Kwajalein, Lae, and Ujae eligible for federal disaster assistance.

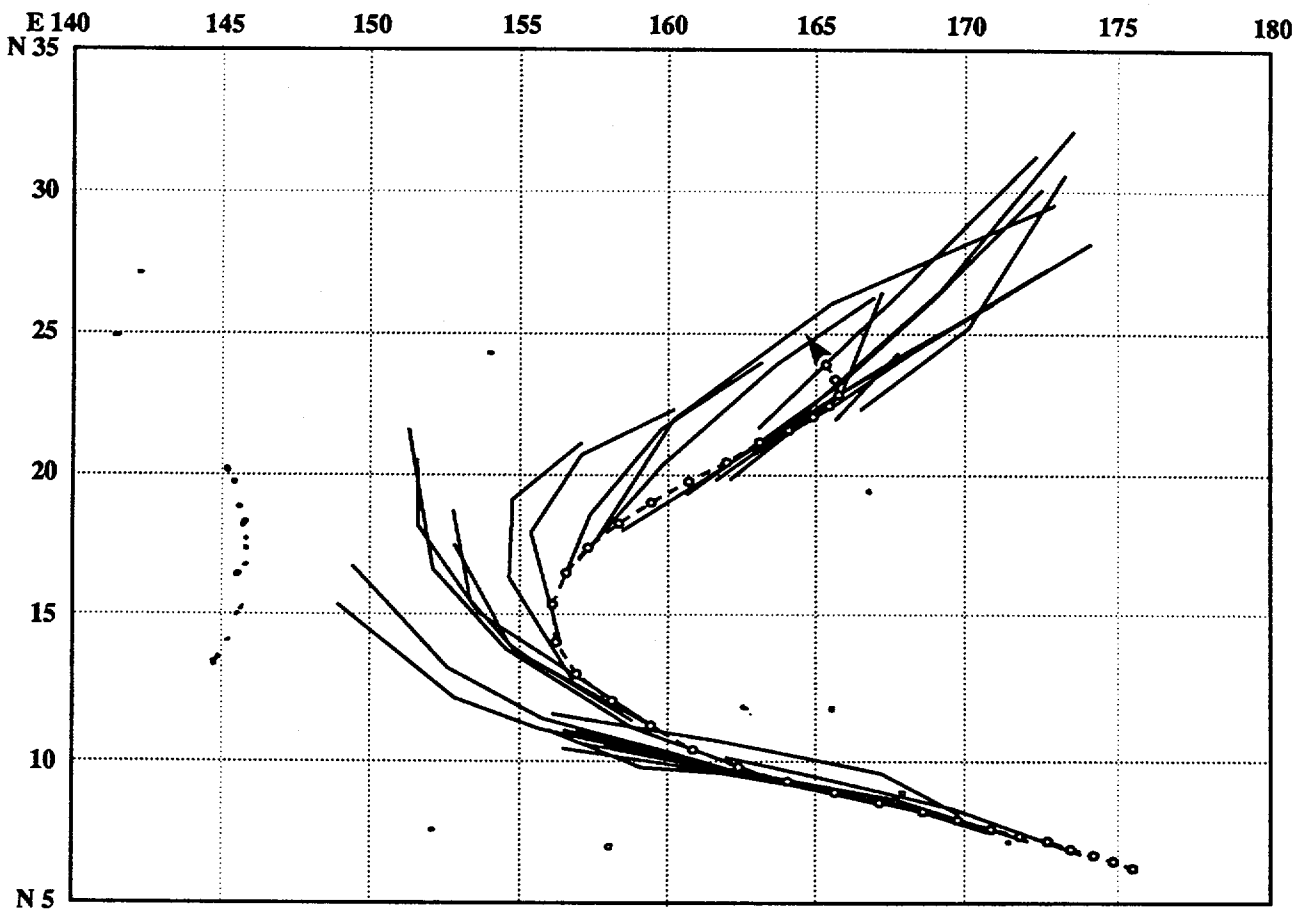


Figure 3-31-3. Comparison of the JTWC official forecasts to the final best track.